

IN THE SPECIFICATION

Please amend the title as follows:

IMAGE PROCESSING ~~CIRCUIT AND CIRCUIT~~, METHOD FOR ~~PROCESSING~~
~~IMAGE AND APPARATUS FOR COMPRESSING A DYNAMIC RANGE~~

Please amend the paragraph beginning on page 3, line 21 as follows:

According to the configuration of the first aspect, when the pixel value of the input image is smoothed while preserving the edge of the input image, only the component determining the dynamic range of the input image can be extracted from the input image separately. Accordingly, when the gain correction coefficient is generated according to the output value of the smoothing processing to correct the pixel value of the input image, the lowering of the contrast of an object that is independent of the dynamic range of the image and is desired to be preserved without compressing it is effectively evaded, and the dynamic range can be compressed at a desired compression rate. Moreover, because the lowering of the contrast of the object can be effectively evaded, the unnatural edge emphasis can also be prevented, and thereby the dynamic range of an input image can be compressed at a high compression rate while quality of the input image is maintained.

Please amend the paragraph beginning on page 7, line 6 as follows:

Incidentally, here, the input image X and the output image Y are two-dimensional digital images. Hereinafter, positions of a pixel in the horizontal direction and the vertical direction are designated by marks "i" and "j", respectively, and the pixel values of the input image X and the output image Y are designated by $x(i, j)$ and $y(i, j)$, respectively. Moreover, respective processed

values corresponding to the pixel values $x(i, j)$ and $y(i, j)$ are similarly designated marks $[[i]]$ "i" and "j", respectively.

Please amend the paragraph beginning on page 9, line 26 as follows:

Now, because in the present embodiment the gain correction coefficient $g(i, j)$ is set to be equal to a value of one or less, the multiplier 5 outputs the image Z having the pixel value $z(i, j)$ that has the compressed dynamic range of that of the input image X as shown in Fig. 5D. Furthermore, because the gain correction coefficient $g(i, j)$ having a value rapidly varying at the edge part owing to the smoothed image S, in which small variations are removed while the edge is preserved, is generated, the multiplier 5 generates the image Z, having the pixel value $z(i, j)$, in which small variations of the pixel value of the input image X are preserved at the parts other than the edge part and only the variation of the pixel value at the edge part is compressed. That is, there is generated the image Z only the general dynamic range of which is selectively compressed.

Please amend the paragraph beginning on page 11, line 2 as follows:

Fig. 8 is a block diagram showing a configuration of a non-linear smoothing unit 2. In the non-linear smoothing unit 2, a two-dimensional linear lowpass filter (LPF) is used as the lowpass filter 11 for smoothing the input image X. The generation of noise in a shape of a point at the following processing is prevented by the smoothing processing of the pixel value $x(i, j)$ of the input image X in advance to some extent. Incidentally, by the use of one-dimensional linear lowpass ~~filters~~ filters in the horizontal direction and the vertical direction of the input image X severally as the lowpass filter 11, the similar processing can be performed.

Please amend the paragraph beginning on page 12, line 23 as follows:

Improved ε filters 13AY, 13BY, ~~... are ..~~ have ~~the configuration~~ configurations similar to those of the improved ε filters 13AX, 13BX, .. except the point that the improved ε filters 13AY, 13BY, .. performs the smoothing processing in ~~regard of~~ the vertical direction. Accordingly, the improved ε filter 13AY, which is the first stage of the improved ε filter 13AY, 13BY, .., is configured so that the image data is changed in its arrangement by the use of a memory not shown in the figure and is input to the improved ε filter 13AY. By the aforesaid configuration, the non-linear smoothing unit 2 performs the smoothing processing of the input image in its horizontal direction and its vertical direction over a wide frequency band while preserving the edge thereof.

Please amend the paragraph beginning on page 13, line 7 as follows:

A look-up table 14 performs the inverse logarithmic transformation of the image ~~date~~ data that was smoothed by the improved ε filters 13AY, 13BY, .., conversely to the look-up table 12, and outputs the transformed data. A lowpass filter 15 is a linear lowpass filter like the lowpass filter 11, and slightly dulls the edge of the output image L3 output from the look-up table 14 that was smoothed while preserving the edge. Thereby, a part in the vicinity of the edge of the output image Y is smoothed so that occurrence of unnatural feeling resulted by a series of the processing may be obstructed.

Please amend the paragraph beginning on page 14, line 15 as follows:

Thereby, when the output value s_n of a pixel p_n having a pixel value r_n is computed, as shown in Fig. 9A, a weighting addition processing is performed as follows: that ~~it is~~ is, as to the pixel p_{n-k} at which the absolute value of the difference between the central pixel value r_n and the

pixel value of the pixel p_{n-k} $r_n - r_{n-k}$ is larger than the reference value ε among the pixels p_1 - p_{2N+1} being objects of the computation processing, the pixel value r_{n-k} is replaced with the central pixel value r_n . Moreover, as to the pixel p_{n-k} at which the absolute value of the difference of the pixel values $r_n - r_{n-k}$ is equal to or less than the reference value ε , the pixel value r_{n-k} of the pixel p_{n-k} is used.

Please amend the paragraph beginning on page 22 line 11 as follows:

In the aforesaid configuration, in the image processing circuit 1 (Fig. 4), the input image X, which is an photographed result or the like, is input into the non-linear smoothing unit 2 (Fig. 5A and Fig. 5B), and the input image X is processed to be smoothed while the edge thereof is preserved by the non-linear smoothing unit 2, and thereby the smoothed image S is generated. Because the smoothed image S is here processed to be smoothed while the edge thereof is preserved, the components that determine the contrast of the object and are desired to be preserved without being compressed and further are independent of the dynamic range of the image are removed, and only the components that ~~determines~~determine the dynamic range of the image ~~is~~are separately taken out.

Please amend the paragraph beginning on page 28 line 18 as follows:

Moreover, in a case where a pixel value is replaced by the judgment of that the pixel is at the edge part, the pixel value to be replaced is determined on the basis of the function obtained in such a way. Accordingly, the variations of the pixel value at such a low frequency are reflected to the weighting processing, and thus it becomes possible to make the output image having far ~~high~~higher quality.

Please amend the paragraph beginning on page 28 line 27 as follows:

Moreover, in the present embodiment, a series of processing can be executed by the simple configuration such that a straight line inclination is ~~obtains~~obtained by the application of the linear function as the function, and further that the processing of the judgment and so on are executed by using the straight line inclination obtained.

Please amend the paragraph beginning on page 31 line 7 as follows:

Moreover, when the input image X is smoothed while the edge thereof is preserved, a plurality of filtering processing with the sampling pitches which are different from each ~~others~~other are repeated, and then ~~an~~a uniform smoothing processing in the wide frequency band can be performed. Accordingly, the output image Y having high quality can be output.

Please amend the paragraph beginning on page 35 line 12 as follows:

The image processing circuit 61, as shown in Fig. 19, eliminates noises of the input image X in advance with a noise elimination filter 62, and then enlarges the dynamic range of the input image X by the multiplication of a uniform gain with the successive multiplier 63 (Fig. 20A and Fig. 20B). After the multiplication processing, the image processing circuit 61 compresses the dynamic range with the image processing circuit 1 to the original dynamic range of the input image X, and ~~output~~outputs the processing results (Fig. 20C).

Please amend the paragraph beginning on page 36 line 28 as follows:

Fig. 21 is a block diagram showing an image processing circuit 71 in accordance with a fifth embodiment of the present invention. In the image processing circuit 71, the matrix circuit 72 performs the computation processing of color signals R, G and B of red, ~~blue-green~~blue and ~~green~~blue, respectively, to generate a luminance signal Y and color difference signals R-Y, B-Y.

Please amend the paragraph beginning on page 39 line 7 as follows:

Moreover, in the aforesaid embodiments, a case where continuing pixel values are sampled at a prescribed sampling pitch to process them in the improved ε filter is described. However, the present invention is not limited to the case. All the continuing pixels may be used to process if a circuit with a sufficient capability is available in practice or the like.

Please amend the paragraph beginning on page 39 line 15 as follows:

Moreover, in the aforesaid embodiments, a case where the input image is smoothed by repetition of the smoothing processing of the improved ε filter is described. However, the present invention is not limited to the case. The repetition processing may be omitted if practically sufficient ~~characteristic~~ characteristics can be obtained in other ~~way~~ ways.

Please amend the paragraph beginning on page 40 line 25 as follows:

Although the invention has been described in its preferred form with a certain degree of particularity, obviously many changes and variations are possible therein. It is therefore to be understood that the present invention may be practiced than as specifically described herein without departing from scope and the ~~spirit~~ spirit thereof.